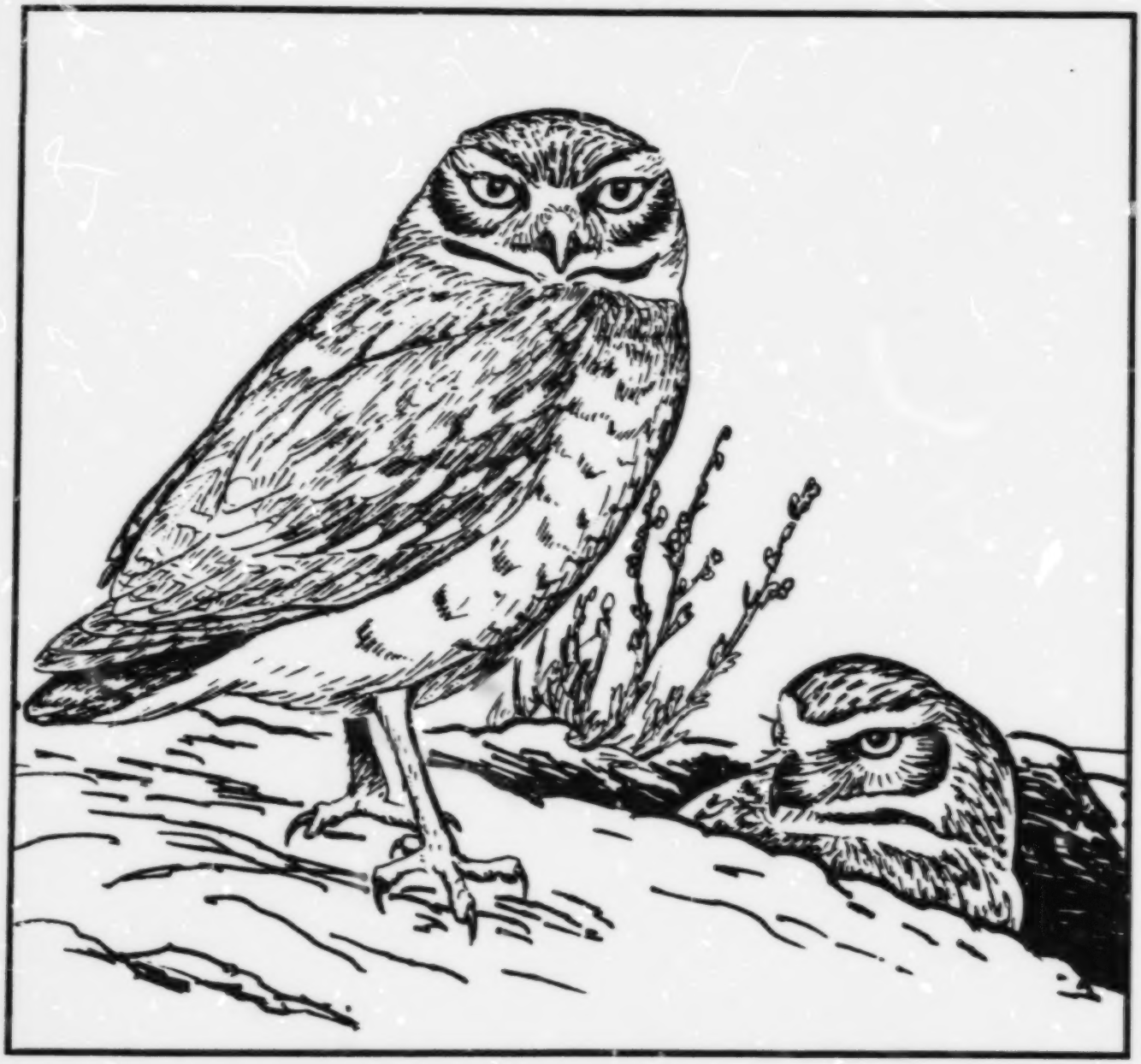
Saskatchewan
Parks, Recreation
and Culture

Hon. Colin Maxwell
Minister

A Stratified Random Survey for Burrowing Owls

Wildlife Technical Report — 87-2



A STRATIFIED RANDOM SURVEY FOR BURROWING OWLS ON THE WEYBURN (62E) AND REGINA (72I) MAP AREAS

BY

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INTRODUCTION

The Burrowing Owl has been designated as a threatened species by the Committee On The Status of Endangered Wildlife In Canada (COSEWIC). The Burrowing Owl has disappeared as a breeding species in British Columbia (Munro, Lincoln and Ritcey 1984) and declined to 35 pair in Manitoba (Ratcliff 1986). Although Alberta and Saskatchewan are the heart of the Burrowing Owl's range in Canada, field surveys to determine population status in Saskatchewan have been confined to the Saskatoon region. (Haug 1985 and Wedgewood 1976).

One problem when doing population surveys for a scarce bird is that large areas are not occupied by the species. Searching these vacant areas demands large amounts of time and result in finding very few individuals. One approach to this problem is to identify preferred areas and concentrate survey efforts there. This technique may under estimate the total population, but it offers substantial labour savings and was selected for this study.

The objectives of the study were to (1) provide a statistically valid estimate of size of the Burrowing Owl population in southeastern Saskatchewan and to estimate rates of occupancy of suitable habitat; (2) to study habitat preferences of Burrowing Owls; (3) to test a stratified random sample technique on a rare species, and (4) to gather other information relevant to management of the Burrowing Owl.

STUDY AREA

This survey was confined to the Weyburn (62E) and Regina (72I) 1:250,000 map areas of the National Topographic Survey. The survey block thus consisted of 2 rectangles touching each other at one corner. Each map area was treated as a separate block.

The Weyburn map area is bounded by the 49 and 50 N. latitude and 102 and 104 W. longitude. Major geographic features are the cities of Weyburn and Estevan, the Souris River Valley and the Missouri Couteau. Most of the land lies within the Moose Mountain Upland and the Souris River Plain. The latter region includes extensive areas of solonetzic soils which appeared attractive to Burrowing Owls.

The Regina map area is bounded by 50 and 51 N latitude and 104 and 106 W. longitude. Important geographic features include the cities of Regina,and Moose Jaw, the Qu'Appelle River Valley, and the Missouri Couteau. Much of the map sheet is occupied by the Assiniboine River Plain. While it is extensively cultivated the lacustrine soils of this plain were attractive to Burrowing Owls in the few areas where grassland remained. Larger grassland areas are found in the Missouri Couteau and Old Wives Lake plain along the western side of this map area.

METHODS

The actual survey was confined to areas believed to be most attractive to Burrowing Owls. These were defined according to lands systems as mapped by Stelfox (1979) and Flory (1980) and presence of grassland.

Selection of land systems for the survey was based on Harris and Lamont (1985) who plotted all known Burrowing Owl locations and investigated nest densities on different land systems. This data indicated selection by Burrowing Owls for the alluvium, drainage, fluvial, fluvial-lacustrine, lacustrine and solonetzic land systems on the Regina Map Sheet and the solonetzic land system on the Weyburn Map sheet. These land systems were selected as primary habitat for the survey, all other areas were left out of the survey design.

Within the primary habitat all areas of grassland were identified from 1979 aerial photographs and marked on 1:50,000 topographic maps. Grassland areas were then assigned to one of the 4 survey strata according to plot size (Table 1). Plot numbers were assigned separately for each statra, and 10% of the plots in each strata on each of the 2 map areas were then randomly selected for field surveys.

Table 1. Definition of Strata

Strata #	Definition
1	Plot less than 5 acres (2ha).
2	Plot between 4 and 30 acres (2 and 12 ha).
3	Plots larger than 30 acres (12 ha). Large blocks of grassland were split into adjacent plots of approximately 40 acres (16 ha) each.
5	Linear plots 1 km (.625 miles) in length, usually along a road or railroad.

To test the assumption that all Burrowing Owls nested on grassland on the primary habitat additional Burrowing Owl observations were obtained from:

(a) A direct mailing to all farmers at Belle Plaine, Drinkwater, Kronau, Pense, Rouleau, Sedley and Wilcox (Appendix 1),
(2) incidental observations by observers working on the project, and
(3) other sightings reported in response to information in the press or other contact.

All observations were plotted on 1:50,000 maps to determine whether they fell within the selected habitats.

All study plots were surveyed between 8 May and 9 August 1986. The junior author surveyed approximately 70% of the areas with SPRR staff and SNHS volunteers doing the remaining areas. Seventy-five per cent of all plots were searched in the morning although surveys were accepted throughout the day provided the wind remained at or below 5 on the Beaufort Scale.

Plots were initially scanned with binoculars, then searched on foot. Type 5 plots along roads were normally surveyed from a slow moving car. The stratum 3 plots were covered by walking two transects 125 m in from either edge. The surveyor thus inspected an area approximately 100 m wide on either side of her path. Surveyors detoured to inspect burrow sites, ground squirrel or badger holes and areas which appeared to contain better habitat during the walking survey. These areas included open sites with few shrubs, hill tops and ridges. Active burrows were identified by seeing owls or by the presence of fresh tracks and pellets at mounds.

Locating actual plot boundaries was challenging where plots were located on large pastures. Surveyors used compass angles to known points and pacing to help locate the plot boundary. The junior author, who surveyed most of these areas, found 500 paces closely approximated the width of a 40 acre plot and used this measure in open pastures.

For each plot, the surveyor recorded the time, weather, number of owls and a series of habitat features. The land system and soil type for each plot were identified later from Land System Maps (Stelfox 1979 and Flory 1980) and soil survey maps (Mitchell, J., H.C. Moss and J.S. Clayton 1944 and Ellis et al 1965). The actual instructions to surveyors are included as Appendix 2.

Exceptions to normal survey procedure occurred when plots were cultivated or did not fit their size category. Cultivated plots were not surveyed for owls. Twelve plots did not fit the assigned strata. They were reallocated as follows: 2 from strata 1 to strata 2, 4 from strata 2 to strata 1, 1 from strata 3 to strata 1 and 5 from strata 3 to strata 2. These plots were then surveyed in the normal fashion.

Survey data from each plot was keypunched and analysed using the Statistical Analysis System. All actual observations of Burrowing Owls were forwarded to the Canadian Wildlife Service and added to their computerized list of nest sites of endangered species.

RESULTS

Habitat Loss

In total 9371 plots were identified and 911 surveyed on the 2 map areas (Table 2). Since the air photos were taken in 1979, 21% of all plots had been cultivated, a substantial loss of potential Burrowing Owl habitat in 7 years. The rate of loss was highest in the 5-30 acre plots (stratum 2) on the Weyburn Map Area and in both strata 1 and 2 (smaller than 30 acres) on the Regina Map Area. Only the roadside linear transects were relatively secure (Table 3).

Table 2: Numbers of plots identified and surveyed in each strata on the Regina and Weyburn Map Areas.

	Regina Map Area		Weyburn Map Area	
Strata	Total Plots	Plots Surveyed	Total Plots	Plots Surveyed
1	662	73	706	59
2	988	99	514	50
3	3842	367	1807	185
5	570	55	282	23
Total	6062	594	3309	317

Table 3: Number and percentage of survey plots cultivated between 1979 and 1986 on the Weyburn and Regina Map Areas.

Map Area	Strata	# Plots Surveyed	# Plots Cultivated	Percent Cultivated
Weyburn	1	59	10	16.9%
Weyburn	2	50	19	38.0%
Weyburn	3	185	37	20.0%
Weyburn	5	23	0	0.0%
Regina	1	73	22	30.1%
Regina	2	99	29	29.3%
Regina	3	367	72	19.6%
Regina	5	55	2	3.6%
Total		911	191	21.0%

Table 4: Estimated Burrowing Owl population on Weyburn and Regina Map Areas. The total number of plots has been reduced by the percentage shown to be cultivated.

Strata	Number of Uncultivated Plots	Number of Uncultivated Plots Surveyed	Mean # of Owls/ Plot	Standard Deviation	Variance	Population Estimate With 95% Confidence Limit (Pairs)
Weyburn						
1	587	45	0	0	0	0
2	319	31	.129	.562	.316	41
3	1445	147	.054	.256	.066	78
5	282	23	0	0	0	0
Total	2633	246				119 ± 82.5
Regina						
1	463	51	0	0	0	0
2	699	67	0	0	0	0
3	3089	285	.028	.324	.105	86.5
5	549	53	0	0	0	0
Total	4800	456				86.5 ± 107

Burrowing Owl Population

This survey confirmed that the Burrowing Owl is a rare resident of south-eastern Saskatchewan. Of 703 suitable plots surveyed (we examined 911 plots, 191 of which were cultivated and 17 of which were not suitable for other reasons such as being flooded) only 13 were occupied by Burrowing Owls. The number of pairs on each occupied plot varied from 1 to 5 with a mean of 2.7 pair. Only 1.8% of plots were occupied; 98.2% of all grasslands in the area we designated as primary habitat were not occupied by Burrowing Owls.

A population estimate and 95% confidence limits for each Map Area were calculated according to Stewart (1983). Owls were only found in strata 2 and 3 (Table 4). The population for the Weyburn Map Area is estimated to be 119 $\pm$ 82.5 pair, while the Regina Map Area is estimated to have 86.5 $\pm$ 107 pair of Burrowing Owls.

Reports from the public and incidental observations provide a check on the accuracy of the surveys. These checks did not reveal any owls which we missed on surveyed plots, suggesting that the field surveys were accurate. Burrowing Owls were reported from 28 plots which were not surveyed. This is within the predicted number, but the distribution of the sightings amongst strata indicates some error in the population estimate.

The survey found no Burrowing Owls on strata 1 or 5, or on stratum 2 in the Regina Map Area. However incidental reports of Burrowing Owls we received on 5 unsurveyed plots in stratum 1, 6 on stratum 2, and 1 on stratum 5, all on the Regina Map Area. This includes 41% of the 29 plots where owls were reported on the Regina Map Area, suggesting that the population estimate for the selected primary habitat could be as much as 40% too low.

A second possible source of error arises in the case of owls nesting on areas not selected as primary Burrowing Owl habitat. Burrowing Owls were reported from 29 sites excluded by our survey. Table 5 shows the most common reason was that grassland areas had been missed in interpretation of aerial photographs.

Table 5: Burrowing Owl Reports from sites included in the survey.

Reason Site Was Not In the Survey	Number of Sites Regina	Weyburn
Land system not designated as primary habitat	3	3
Land cultivated	2	0
Grassland not identified from air photos	13	2
Narrow road ditch not selected as a type 5 plot	6	0
Total	24	5

On the Regina Map Area, the owl observations at 24 sites not covered by this survey represented 45% of all reported Burrowing Owl sites. On the Weyburn Map Area 31% of the occupied sites were not covered by the survey. This suggests the relative magnitude of this source of error for the survey.

Combining these two sources of error suggests the population of Burrowing Owls could be double that estimated in Table 4. This would produce a total population of about 200 pair on each map area with large amounts of vacant habitat but does not alter the basic conclusion that the Burrowing Owl is a rare and threatened species in southeastern Saskatchewan. This conclusion was reinforced during the survey by repeated comments from farmers who where familiar with the Burrowing Owl but "hadn't seen them for a few years now".

Habitat Selection

The study was designed to compare habitat composition between occupied and unoccupied vacant sites. Unfortunately the number of occupied sites was far too small to allow statistical comparison. Actual data on habitat features is presented for surveyed plots in Tables 6 to 11. Data are combined for the Regina and Weyburn Map Areas and for all strata in these tables.

Table 6: Vegetation at surveyed plots on Weyburn and Regina Map Areas.

Vegetation Type	# of Plots Occupied by Burrowing Owls	# of Unoccupied Plots
Native Grass	3	70
Native Grass and Shrubs	4	215
Alfalfa and Brome Grass	0	120
Other Domestic Grass Mixtures	4	160
Mixed Native and Domestic Grasses	2	114
Other	0	3
Total	13	691

Table 7: Vegetation condition at surveyed plots on Weyburn and Regina Map Areas.

Vegetation Condition	# of Plots Occupied by Burrowing Owls	# of Unoccupied Plots
Not mowed or grazed	1	221
Recently Mowed	1	59
Mowed last year	0	71
Heavily grazed	1	26
Grazing leaves mix of short and tall grass areas	4	69
Grazing leaves grass more than 1 inch tall	0	43
Grazing leaves grass more than 6 inches tall	6	193
Other	0	9
Total	13	691

Table 8: Land system at surveyed plots on Weyburn and Regina Map Areas.

Land System	# of Plots Occupied by Burrowing Owls	# of Unoccupied Plots
Alluvium	0	34
Drainage	1	20
Fluvial	2	131
Fluvial-Lacustrine	1	65
Lacustrine	0	133
Saline	0	11
Solenetzic	9	251
Other	0	46
Total	13	691

Table 9: Soil type at surveyed plots on Weyburn and Regina Map Areas.

Soil Type	# of Plots Occupied by Burrowing Owls	# of Unoccupied Plots
Sandy loam gravel	1	96
Silt	0	0
Silt loam	0	1
Loam	4	114
Sandy loam	0	83
Loamy sand	0	21
Sand	0	0
Sandy clay loam	0	3
Clay loam	5	162
Sandy clay	0	1
Silty clay loam	0	7
Silty clay	0	0
Clay	0	21
Heavy clay	0	119
Other	3	54
Unknown	0	8
Other	13	691

Table 10: Availability of Richardson Ground Squirrel burrows at surveyed plots on Weyburn and Regina Map Areas.

# of Burrows on Plots	# of Plots Occupied by Burrowing Owls	# of Unoccupied Plots
0	1	310
1-5	2	125
6-10	1	56
11-20	3	55
More than 20	6	116
Data not collected	0	28

Table 11: Availability of Badger Holes at surveyed plots on Weyburn and Regina Map Areas.

# of Badger Holes on Plot	# of Plots Occupied by Burrowing Owls	# of Unoccupied Plots
0	8	531
1-5	4	104
6-10	1	17
11-20	0	13
More than 20	0	2
Data not collected	0	24
	13	691

We observed 17 nests on the surveyed plots. Eleven of these nests were in expanded ground squirrel holes, 3 were in nest boxes, and 3 were of other origin.

Discussion

The stratified random survey technique used in this study has advantages and disadvantages. The advantage is that the relative abundance of the species is established and the perceived rarity of the Burrowing Owl in south-eastern Saskatchewan cannot be discounted as an artifact of not looking. Other approaches, such as soliciting reports from landowners, always leave that possibility untested. The drawback to this design is that it is labour intensive. With a rare species this results in large

confidence limits on the population estimate. For the Regina Map Area the confidence limit exceeds the population estimate, yet to significantly increase the number of owls observed would require doubling the survey and an additional 15 weeks work. In addition, the decision to survey only designated primary habitats in order to save labour created a potential source of error.

We recommend this survey be used for threatened and endangered species which can be surveyed relatively easily or which are locally common enough to reduce the number of vacant plots. This design may also be used in order to determine actual rarity when the population is unknown. However, for future Burrowing Owl surveys in Saskatchewan we recommend use of other techniques, such as landowner contact, which will more efficiently provide a minimum population estimate even though we will not know what portion of the population the survey missed.

This survey showed the Burrowing Owl population is small in south-eastern Saskatchewan and probably does not exceed 400 pair. Comments from farmers suggest the population is declining. This observation is supported by the large number of unoccupied plots, many of which appeared suitable for Burrowing Owls. The fact that only two Burrowing Owl colonies containing more than 5 pair were located is also of concern, as these larger colonies are more stable and may be very important to retention of the population.

While vacant habitat was observed, cultivation of 21% of all designated primary habitat plots since 1979 indicates that habitat loss is a real and continuing threat to the Burrowing Owl. We suspect the problem is greater than simple habitat loss. Increasing isolation of remaining habitat blocks probably reduces their chances of being found by Burrowing Owls and contributes to the high percentage of unoccupied sites. However, the present study was not designed to test this hypothesis.

CONCLUSION AND RECOMMENDATION

The Burrowing Owl population in southeastern Saskatchewan is small and declining. Habitat loss contributes to the decline, but is not the only cause. The threatened designation should be maintained for burrowing owls in Saskatchewan.

Additional management efforts are needed for the Burrowing Owl. These include:

1. A survey based on advertising to farmers to determine locations and numbers of owls across the rest of the species range in Saskatchewan;

2. Initiation of a habitat protection program for known nesting areas, especially those supporting colonies of Burrowing Owls;

3. Determining whether pesticide use poses a threat to Burrowing Owls;

4. Development of techniques to attract or transplant Burrowing Owls to secure but unoccupied habitats which could support colonies of 5 or more pair;

5. Study of survival and movements of Burrowing Owls between colonies to determine the importance of the large colonies in maintaining peripheral breeding populations.

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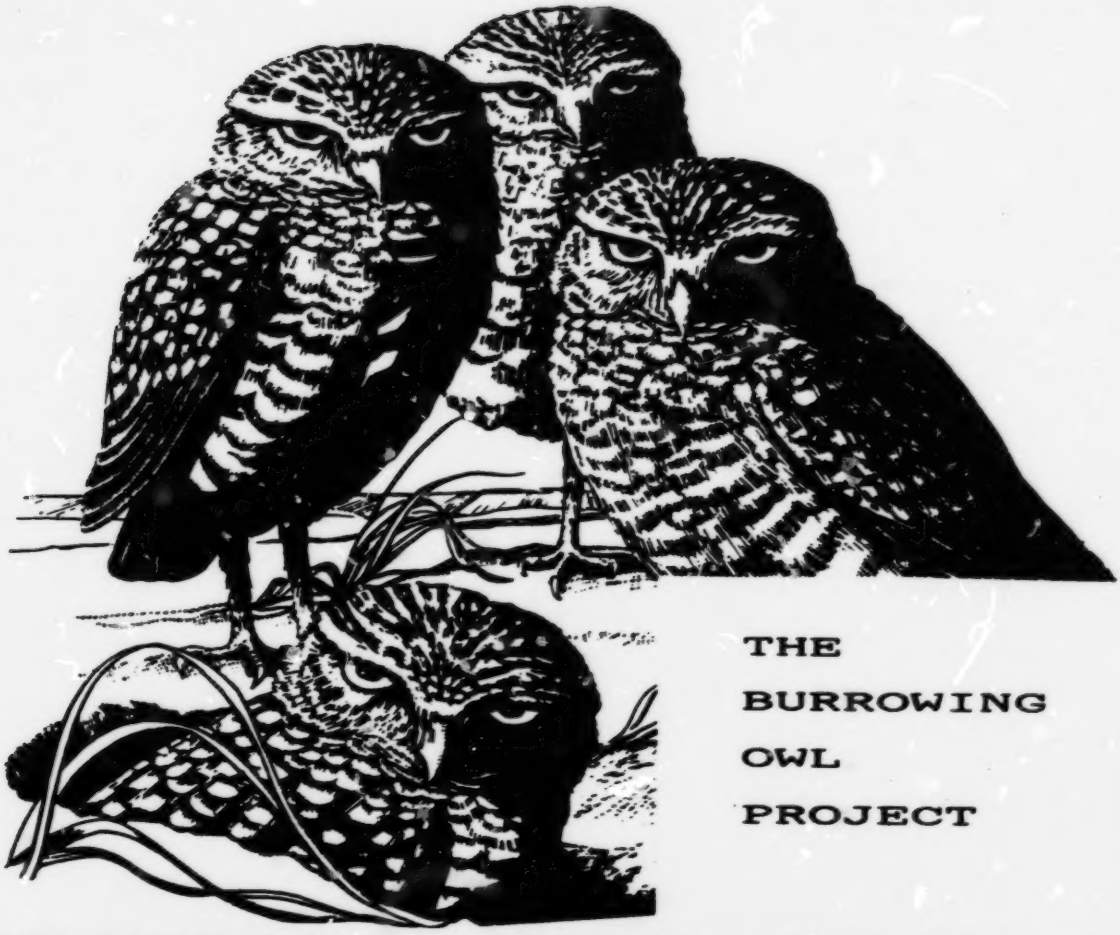
Appendix 1: Burrowing Owl Mail Questionnaire



THE BURROWING OWL PROJECT

ALSO CALLED THE GROUND OWL, THE BURROWING OWL IS A RARE SPECIES IN CANADA. THEY USUALLY NEST IN OLD BADGER OR GOPHER HOLES, WHERE IT LAYS SEVEN TO EIGHT EGGS. IT FEEDS ON MICE, GRASS HOPPERS, CRICKETS AND SIMILAR SMALL PREY. THE OWL HUNTS OVER PASTURE AND CULTIVATED FIELDS, BUT PREFERS A PLOT OF GRASS FOR NESTING. THE LOSS OF PASTURE LAND AND THOUGHTLESS SHOOTINGS ARE RESPONSIBLE FOR THE DECLINE OF THIS SPECIES. THESE ATTRACTIVE LITTLE BIRDS ARE HARMLESS AND IN FACT HELPFULL TO THE ENVIRONMENT, THEY ARE THE FARMERS FRIEND.

THE SASKATCHEWAN NATURAL HISTORY SOCIETY IS STUDYING THIS OWL TO LEARN HOW MANY ARE LEFT IN THE PROVINCE AND WHERE THEY ARE MOST COMMON.

IF YOU HAVE SEEN ANY BURROWING OWLS THIS YEAR, WE WOULD LIKE TO KNOW. PLEASE FILL IN AND SEND US THE QUESTIONARE

HOW MANY? _____ WHEN? (date) _____

WHERE? _____ SEC _____ TP _____ RANGE _____ CLOSEST TO _____

IN THE RURAL MUNICIPALITY OF _____

NAME _____ ADDRESS _____

Thank you for helping us with the Burrowing Owl Project. Please fold this questionare so that our address shows, staple or scotch tape closed and mail your information to us.

34¢
STAMP

THE BURROWING OWL PROJECT
PO BOX 1000,
BELLE PLAINE,
SASKATCHEWAN,
S0G 0G0

TO THE FARM RESIDENT

FROM THE BURROWING OWL PROJECT

Appendix 2: Instruction for Burrowing Owl Survey

INSTRUCTIONS FOR BURROWING OWL SURVEY

The goal of this survey is to determine how many Burrowing owls there are on a series of preselected plots and to record characteristics of the habitat. In total we will be looking at about 10 % of the Burrowing Owl habitat. The survey will allow the first ever accurate estimate of total population in the area and allow a better understanding of the Burrowing Owl's habitat preferances.

It is important that each plot be surveyed carefully, preferably by walking(of course the long road transects may be driven slowly). Investigate holes that look active. An active Burrowing Owl nest will have owl pellets around it, a very good indicator of an active site. Generally, of course, you will see the owls.

If you find your plot is now cultivated, totally forested or cannot be done for some other reason such as a hostile landowner simply note that fact and go on to the next one. All plots were selected according to air photos and should have native vegetation. However the photos are seven years old so a number of changes may have occurred. Please do try to get to and do all plots in your area, nonetheless I realise that one or two plots somewhere will be impossible.

Please record the following data on the data sheet provided using numeric codes. If my instructions confuse you and you are not certain how to fill in the sheet, please record all the data requested on other paper and I will fill in the data sheat. If you see Burrowing Owls off the study blocks please record their location on the map and report the site to me. I am interested in all nest locations and am using off plot sitings as part of a larger study.

1 MAP SHEAT SURVEYED (1 digit)
- 1 Weyburn (62E) and Virden (62F)
- 2 Mellville (62L and 62K)
- 3 Regina (72I)
- 4 Willowbunch (72H)

2 Plot Type (1 digit)
- 1 less than 5 acres = NG1
- 2 5-30 acres = NG2
- 3 Larger than 30 acres = NG 3 or 4
- 5 Linnear blocks, usually road ditches or raillines

3 Plot #(3 digits)
The number on the map

4 Temperature (2 digits)
Estimate of degres in Celsius

5 Wind Speed (1 digit)
Please enter according to the Beaufort Code rather than in miles or kilometres per hour. The code follows.
- 0 . Calm, smoke rises vertically.

1 Very light breeze, wind direction shown by smoke drift.
2 Wind can be felt on face, leaves rustle.
3 Leaves and small twigs are in constant motion; light flag extended.
4 Raises dust and loose paper; small branches are moved.
5 Small trees in leaf sway; crested wavelets on water.
6 Windier than that and probably too windy to be doing surveys.

6 Sky Condition (1 digit)
0 Clear or few clouds
1 Partly cloudy or variable sky
2 Cloudy(broken) or fully overcast
4 Fog or smoke
5 Drizzle
8 Showers

7 Total Number of adult owls seen on plot (2 digits)

8 Number of pairs believed to be on plot. This might be determined by seeing pairs or because you see the male and think it represents a pair or even because a burrow has fresh tracks and many owl pellets around it. For example if I saw 1 pair together by a burrow, a male sitting by a second burrow, and found a third burrow some distance away with fresh tracks and owl pellets around it, I would enter 3 under point 7 because I saw 3 owls. I would enter 3 here as well because I believe there are 3 burrows occupied by 3 pair.

Be careful interpreting occupied burrows. Owls may have secondary burrows, but these should not be heavily used. If you see a probable burrow with no owls watch it a while. You will probably see an owl after a while. (2 digits).

9 Number of badger holes (1 digit)
These are a main source of nest sites. Enter the appropriate code according to how many burrows you saw.
0 No badger holes.
1 1-5 badger holes.
2 5-10 badger holes.
3 10-20 badger holes.
4 more than 20 holes.

10 Number of Richardson Ground Squirrel holes (1 digit)
Again this is a source of nest sites and enter the appropriate code. Note that I don't expect you find every hole, this is based on what you notice while walking.
0 No gopher holes.
1 1-5 gopher holes.
2 5-10 gopher holes.
3 10-20 gopher holes.
4 more than 20 holes.

11-14 Source of nest sites (1 digit each)

Enter the number of owl nests which were in badger holes (point 11), ground squirrel holes (point 12), artificial boxes(point 13), or of other or unknown origin (point 14). If you were to find more than 9 nests on the plot which were in, say badger holes, simply use 9 to indicate 9 or more.

15 Type of vegetation(1 digit)
Use the code which applies to the majority of the indicated plot, excluding trees.

0 Cultivated
1 Native grass
2 Native grass and shrubs
3 Alfalfa and brome grass
4 Other domestic grass mixtures
5 Mix of native areas and planted grasses.

16 Condition of vegetation (1 digit)

0 Not mowed or grazed in long time so grass is thick and fairly tall.
1 Recently mowed
2 Mowed last year, not mowed yet this year.
3 Pasture, grazing heavy, grass open and fairly uniformly less than 1 inch tall.
4 Pasture, grazing leaves mix of open areas with short grass and many bunches or patches of taller grass providing cover.
5 Pasture, grazing light, most areas grass is more than an inch tall.
6 Pasture, grazing leaves most of area with grass 6 inches or more tall.

17 Presence of Trees (1 digit)

0 No trees on plot.
1 A few single trees.
2 Several bluffs.
3 A hedgerow on plot.
4 A substantial area treed but still enough grassland to retain as a plot.

18 Water (1 digit)

0 No open water on or adjacent to plot.
1 There is open water on or adjacent to plot.

19 Day of survey.(3 digits)
enter 5,6, or 7 for May, June, and July and then the day.

20 Time (4 digits)
Use 24 hour clock.

.....

Following items to be filed in in the office.

21 Land system(2 digits)
22 Soil type (3 digits).